

# Evidence for the linearization-based theory of semantic composition

## 1 Introduction

It is undeniable that right-node raising (RNR) and left-node raising (LNR) (see Yatabe 2001) can affect quantifier scope; when RNR or LNR merges two or more quantifiers into one, the scope of those quantifiers can be altered, as can easily be seen in the case of an example like *Jo liked, and Ed disliked, exactly half of the movies*. At the same time, there seems to be a growing consensus that RNR and LNR should be analyzed in terms of some linearization-related mechanism rather than the SLASH mechanism (see Yatabe 2001 and Beavers and Sag 2004 for some recent discussion within the context of HPSG). Thus an adequate theory of RNR and LNR must be able to explain how it is that linearization-related mechanisms can affect quantifier scope; a theory like that presented in Kathol and Pollard 1995, which is based on the assumption that semantic composition is not affected by what happens in order domains, turns out to be inadequate.

There have been two proposals about how to allow quantifier scope to be affected by linearization-related mechanisms. One is the theory advanced in Yatabe 2001, in which semantic composition is almost entirely carried out within order domains. The other is the theory proposed in Beavers and Sag 2004, which retains the more conventional view of semantic composition and in which the relevant observations are explained by simply adding a mechanism called *Optional Quantifier Merger* to the grammar.

The aim of this paper is to present evidence that favors the former theory over the latter. First, in Section 2, the two theories that are to be compared will be described in some detail. Then, in Section 3, the results of two questionnaire studies will be presented which appear to favor the theory proposed in Yatabe 2001.

## 2 Two Theories of RNR and LNR

In the theory presented in Yatabe 2001, RNR and LNR are each claimed to come in two varieties: a purely phonological variety and a syntactic variety. The purely phonological variety of RNR and LNR is assumed to be nothing but phonological deletion; a phrase like *the in- and the output of this machine* (Wilder 1997) is assumed to be derived from *the input of the machine and the output of this machine* by deleting the first occurrence of the string *-put of this machine*. On the other hand, the syntactic variety of RNR and LNR is assumed to merge two or more domain objects into one. Since the theory is coupled with a novel theory of semantic composition in which domain objects rather than signs are treated as the principal units of semantic composition, this means that the syntactic variety of RNR and LNR is capable of affecting the meaning of the sentences involved. Figure 1 illustrates the way this theory handles the syntax of RNR in English.

In Beavers and Sag's theory, on the other hand, RNR and LNR are assumed to be phonological deletion in all cases, and what they call *Optional Quantifier Merger* is introduced to explain the fact that RNR and LNR are capable of affecting semantic interpretation. The following is a description of *Optional Quantifier Merger* given in Beavers and Sag 2004.

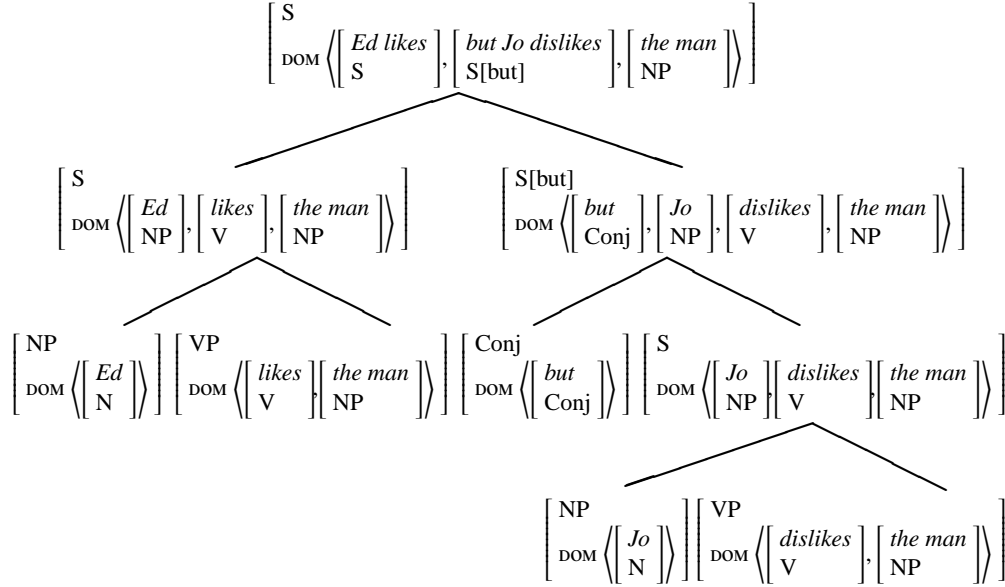


Figure 1: Syntactic RNR in Yatabe's theory

- (1) Optional Quantifier Merger: For any elided phrase denoting a generalized quantifier in the domain of either conjunct, the semantics of that phrase may optionally be identified with the semantics of its non-elided counterpart.

The predictions of the two theories are indistinguishable in many cases, but they differ from each other in the following respect. In Beavers and Sag's theory, the only semantic effect that RNR and LNR can have is to decrease the number of quantifiers involved; neither RNR nor LNR is expected to be capable of suppressing scope island effects. In contrast, in Yatabe's theory, it is expected that RNR and LNR might be able to suppress some scope island effects by moving the quantifier(s) involved out of the relevant scope island; since Yatabe's theory implies (roughly) that a quantifier  $\alpha$  is obligatorily retrieved from quantifier storage when the domain object that represents  $\alpha$  is merged with some other domain object(s) by the total or partial compaction operation, a right-node-raised or left-node-raised quantifier might be assigned a scope that it would not have been able to be associated with had it not been right-node-raised or left-node-raised.

### 3 Questionnaire Studies

Two questionnaire studies were conducted in order to test whether LNR in Japanese is capable of overriding scope island effects. In the first study, involving 16 linguistically naive native speakers of Japanese who were all students at the University of Tokyo, the participants were asked to judge whether the sentences in (2) and (3) had each of the two readings indicated. The sentences were sent to the participants via email together with various unrelated sentences whose status was also to be judged, and the order of the two sentences and the order of their two intended readings were both randomized for each participant. The participants were asked to respond using the following 4-point scale: 1 = "perfectly acceptable under the intended reading", 2 = "slightly unnatural under the intended reading", 3 = "considerably unnatural under the intended reading", and 4 = "completely impossible under the intended reading".

- (2) [Jikihitsu no], [shichi-nin ijô no kokkaigiin no] shomei o morau ka, giin-bajji  
 [hand-written] [seven or more congressperson GEN] signature ACC obtain or congressional badge  
 o kashite morau ka shinakereba naranai.  
 ACC borrow or must do

**Reading 1** ‘I have to either obtain seven or more congresspersons’ hand-written signatures or borrow seven or more congresspersons’ congressional badges.’

**Reading 2** ‘I have to bring about a situation where, for seven or more congresspersons  $x$ , I have either obtained  $x$ ’s hand-written signature or borrowed  $x$ ’s congressional badge (for instance a situation where I have obtained three congresspersons’ hand-written signatures and four congresspersons’ congressional badges).’

- (3) [Shichi-nin ijô no kokkaigiin no], [jikihitsu no] shomei o morau ka giin-bajji  
 [seven or more congressperson GEN] [hand-written] signature ACC obtain or congressperson badge  
 o kashite morau ka shinakereba naranai.  
 ACC borrow or must do

**Reading 1** (Same as Reading 1 of (2).)

**Reading 2** (Same as Reading 2 of (2).)

The only difference between (2) and (3) is the order between the two prenominal expressions *jikihitsu no* and *shichi-nin ijô no kokkaigiin no* (and the location of commas). In (2), the quantificational expression *shichi-nin no kokkaigiin* ‘seven or more congresspersons’ is embedded within the first conjunct; it cannot be interpreted as having been left-node-raised out of the two conjuncts, since it is preceded by a phrase that is unambiguously a part of the first conjunct. In (3), on the other hand, the quantificational expression is at the left edge of the coordinate structure, and can hence be interpreted as having been left-node-raised out of the two conjuncts (the first conjunct that means “to obtain seven or more congresspersons’ hand-written signatures” and the second conjunct that means “to borrow seven or more congresspersons’ congressional badges”). In both cases, Reading 1 is the reading in which the quantificational expression *shichi-nin ijô no kokkaigiin* takes narrow scope within the first conjunct, and Reading 2 is the reading in which the quantificational expression takes wide scope over the entire coordinate structure.

Beavers and Sag’s theory predicts that there should not be any difference in acceptability between Reading 2 of example (2) and Reading 2 of example (3); the quantifier must be able to take wide scope over the entire coordinate structure in both (2) and (3) if these sentences do not contain any scope island, and it must be able to take such wide scope in neither (2) nor (3) if, say, a conjunct is a scope island. Notice that, in this theory, Reading 2 of (2) and (3) can be obtained without invoking LNR (and Optional Quantifier Merger), as long as the quantifier ‘seven or more congresspersons’ is allowed to take scope over the entire coordinate structure; the quantifier must be able to bind the unexpressed possessor of *giin-bajji* ‘congressional badges’ as long as the latter is in the scope of the former.

Yatabe’s theory makes the same predictions as Beavers and Sag’s theory if these sentences contain no scope island, but on the assumption that a conjunct constitutes a scope island, Yatabe’s theory predicts that Reading 2 should be possible in (3) but not in (2), because the quantifier can be interpreted as having been left-node-raised out of the relevant scope island (i.e. the first conjunct) only in (3).

The result of this questionnaire is summarized in (4). The figures in each 4-tuple represent the numbers of participants whose response was 1, 2, 3, and 4 respectively.

- (4) Sentence (2), Reading 1: <7, 6, 2, 1> (mean rating = 1.81)  
 Sentence (2), Reading 2: <4, 1, 6, 5> (mean rating = 2.75)  
 Sentence (3), Reading 1: <5, 4, 6, 1> (mean rating = 2.19)  
 Sentence (3), Reading 2: <7, 4, 5, 0> (mean rating = 1.88)

Reading 2 of sentence (2) was judged to be significantly less acceptable than Reading 2 of sentence (3), [ $T = 3, n = 10, p < 0.01$ ]. Also, Reading 2 of sentence (2) was the only reading whose mean rating was larger than 2.5. (The mean rating can range from 1 (= “perfectly ok”) to 4 (= “completely out”).) This is a result consistent with the prediction of Yatabe’s theory, on the assumption that a conjunct is a scope island.

The second study, involving 30 linguistically naive native speakers of Japanese who were all students at the University of Tokyo, was essentially the same as the first study, but used different examples, shown in (5) and (6).

- (5) [Kyô shôgo no jiten de no] [yattsu ijô no chiten no] kion o keisoku suru ka, [kinô no  
 [at noon today] [of 8 or more locations] temperature acc measure or [of yesterday  
 saikô kion o] toiwaseru ka shinakereba naranai.  
 maximum temperature acc] inquire or must do

**Reading 1** ‘I have to either measure the temperature at eight or more locations at noon today or inquire yesterday’s maximum temperature at eight or more locations.’

**Reading 2** ‘I have to bring about a situation where, for eight or more locations  $x$ , I have either measured the temperature at  $x$  at noon today or inquired yesterday’s maximum temperature at  $x$  (for instance a situation where I have measured the temperature at noon today at three locations and inquired yesterday’s maximum temperature at five locations).’

- (6) [Yattsu ijô no chiten no], [kyô shôgo no jiten de no] kion o keisoku suru ka, [kinô no  
 [of 8 or more locations] [at noon today] temperature acc measure or [of yesterday  
 saikô kion o] toiwaseru ka shinakereba naranai.  
 maximum temperature acc] inquire or must do

**Reading 1** (Same as Reading 1 of (5).)

**Reading 2** (Same as Reading 2 of (5).)

(5) and (6) are analogous to (2) and (3) respectively, and the predictions of the two theories are comparable to those discussed in relation to the first study.

The result of the second study is summarized in (7).

- (7) Sentence (5), Reading 1: <9, 10, 9, 2> (mean rating = 2.13)  
 Sentence (5), Reading 2: <1, 4, 12, 13> (mean rating = 3.23)  
 Sentence (6), Reading 1: <19, 9, 2, 0> (mean rating = 1.43)  
 Sentence (6), Reading 2: <7, 7, 12, 4> (mean rating = 2.43)

Reading 2 of sentence (5) was judged to be significantly less acceptable than Reading 2 of sentence (6), [ $T = 18, n = 19, p < 0.001$ ]. Also, Reading 2 of sentence (5) was the only reading whose mean rating was larger than 2.5. Again, the result is consistent with the prediction of Yatabe’s theory, on the assumption that a conjunct is a scope island.

The difference in acceptability between Reading 2 of example (2) and Reading 2 of example (3) and between Reading 2 of example (5) and Reading 2 of example (6) is difficult if not impossible to account for unless it is assumed (i) that a conjunct is a scope island and (ii) that LNR can nullify such a scope island by moving the quantifier in question out of it. Thus the results described in this section provide a reason to favor Yatabe's theory over Beavers and Sag's theory. The fact that many of the readings that are predicted to be grammatical by Yatabe's theory (as well as by Beavers and Sag's theory) were judged to be less than perfect might seem problematic, but it is in fact quite common for a sentence or a reading that is predicted to be perfectly grammatical by a canonical linguistic theory to be judged as less than perfect; the fact therefore should not necessarily be interpreted as a problem for the theory under discussion here.

## 4 Conclusion

The result of questionnaire studies have been presented which arguably shows (i) that a conjunct is a scope island in Japanese and (ii) that LNR can nullify such scope islands. This finding favors the theory advanced in Yatabe 2001 over the theory proposed in Beavers and Sag 2004. (The full paper will also contain other experimental evidence for the theory of LNR presented in Yatabe 2001 and for the view that it is domain objects rather than signs that function as principal units of semantic composition.)

## References

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